

IN THE SPECIFICATION:

Please change the title as follows:

**AN APPARATUS FOR MANUFACTURING MOLTEN IRONS TO IMPROVE
OPERATION OF FLUIDIZED BED TYPE REDUCTION APPARATUS AND
MANUFACTURING METHOD USING THE SAME**

The paragraph beginning on page 1, line 7 has been changed as follows:

The ~~present~~ invention relates to an apparatus and method for manufacturing molten irons, and more particularly to an apparatus and method for manufacturing molten irons that supplies oxygen and water to a fluidized-bed reactor for increasing a temperature in the fluidized-bed reactor to thereby manufacture molten irons.

The paragraph beginning on page 3, line 2 has been changed as follows:

The ~~present~~ invention has been made in an effort to solve the above problems. The ~~present~~ invention provides an apparatus and method for manufacturing molten iron that supplies oxygen and water directly to a fluidized-bed reactor to increase a temperature of a reaction gas and prevent molten fine ores from adhering to the fluidized-bed reactor thereby improving operation of the fluidized-bed reactor.

The paragraphs beginning on page 5, line 4 have been changed as follows:

FIG. 1 is a schematic view of an apparatus for manufacturing molten iron according to a first embodiment of the ~~present~~ invention.

FIG. 2 is a partial sectional view of an oxygen burner according to a first embodiment of the ~~present~~ invention.

FIG. 3 is a schematic view of an apparatus for manufacturing molten iron according to a second embodiment of the present invention.

FIG. 4 is a partial sectional view of an oxygen burner and a water supply nozzle according to a second embodiment of the ~~present~~ invention.

FIG. 5 is a graph showing changes in an oxygen flame temperature as a function of water supply amount according to an experimental example of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the ~~present~~ invention will now be described in detail with reference to the accompanying drawings. ~~It should be clearly understood that many~~ Many variations and/or modifications of the basic inventive concepts may appear to those skilled in the present art. The embodiments are to be regarded as illustrative in nature, and not restrictive.

FIG. 1 is a schematic view of an apparatus for manufacturing molten iron according to a first embodiment of the ~~present~~ invention. The apparatus is shown in a state where oxygen burners are mounted to fluidized-bed reactors.

An apparatus 100 for manufacturing molten iron according to a first embodiment of the ~~present~~ invention includes the main elements of a fluidized-bed reactor unit 20, a melter-gasifier 10, and other accessory equipments. The fluidized-bed reactor unit 20 includes one or more fluidized-bed reactors having a fluidized bed therein, and acts to reduce and calcine iron ores and additives to reduced material. The reduced material is charged to the melter-gasifier 10, which includes a coal packed bed therein, and oxygen is supplied to the melter-gasifier 10 to thereby produce molten irons. Reduced gas exhausted from the melter-gasifier 10 is used to reduce and calcine iron ores and additives by passing through the fluidized-bed reactors after being supplied to the same via a reduced gas supply line L55, after which the reduced gas is exhausted to the outside.

Elements included in the apparatus 100 for manufacturing molten iron according to the first embodiment of the ~~present~~ invention will now be described in more detail.

The paragraph beginning on page 6, line 13 has been changed as follows:

As shown in FIG. 1, the fluidized-bed reactors in the first embodiment of the ~~present~~ invention are realized through three stages. This number of the fluidized-bed reactors is for illustrative purposes only and is not meant to restrict the ~~present~~ invention. Accordingly, a variety of different numbers of stages may be used for the fluidized-bed reactors.

The paragraphs beginning on page 8, line 4 have been changed as follows:

In the first embodiment of the ~~present~~ invention, in order to prevent reduced gas raised in temperature from damaging or blocking a dispersing plate mounted to a lower area of the fluidized-bed reactors and through which reduced gas passes, oxygen is directly supplied to and combusted in an area where reduced gas flows to fluidized beds of the fluidized-bed reactors. To realize this in the ~~present~~ invention, as shown in the enlarged circle of FIG. 1, an oxygen burner 60 is mounted to an exterior wall of each of the fluidized-bed reactors at an area above a dispersing plate 27. Therefore, the reduced gas is minimally increased in temperature by the oxygen supplied through the oxygen supply apparatuses 71, 72, and 73. Also, it is possible to further increase the temperature of the reduced gas by operation of the oxygen burners 60.

In the case where oxygen is supplied and combusted through the oxygen burner 60 shown in the enlarged circle of FIG. 1, a combustion area 44 is formed in the vicinity of the oxygen burner 60. In the first embodiment of the ~~present~~ invention, oxygen is directly supplied to and combusted in the area where reduced gas flows to the fluidized beds in the fluidized-bed reactors. Accordingly, with the formation of the combustion area 44 in the area where the fluidized beds are formed where the dispersing plate 27 is already passed, any negative affect given to the dispersing plate 27 is minimized.

In the first embodiment of the ~~present~~ invention, one of the oxygen burners 60 is preferably mounted to the pre-heating reactor 24 and to the preliminary reducing reactor 25 for direct supply and combustion of oxygen. Since a reduction rate of the iron containing mixtures forming a fluidized layer is not very high in the pre-heating reactor 24 and the preliminary reducing reactor 25, even if contact is made with the oxygen flame, molten cohesion of the iron containing mixture is not very significant. In contrast to this, material forming the fluidized beds reaches a reduction rate of a predetermined level in the final reducing reactor 26 such that there is concern for molten cohesion of the fine direct reduced iron such that oxygen is preferably not directly supplied to the final reducing reactor 26.

The paragraph beginning on page 9, line 9 has been changed as follows:

FIG. 2 is a partial sectional view of one of the oxygen burners 60 according to the first embodiment of the ~~present~~ invention. Since an exterior of the oxygen burner 60 is easily understood by those skilled in the art, only a sectional view of this element is shown.

The paragraphs beginning on page 10, line 5 have been changed as follows:

A second embodiment of the ~~present~~ invention will be described below with reference to FIGS. 3 and 4.

FIG. 3 is a schematic view of an apparatus for manufacturing molten iron according to a second embodiment of the ~~present~~ invention. The apparatus is shown in a state where oxygen burners and water supply nozzles are mounted to fluidized-bed reactors.

An apparatus 200 for manufacturing molten iron according to a second embodiment of the ~~present~~ invention is identical to the apparatus of the first embodiment except for the water supply nozzles. Therefore, an explanation of these identical elements will not be provided and the description will be concentrated on the water supply nozzles.

The paragraph beginning on page 10, line 16 has been changed as follows:

As shown in the enlarged circle of FIG. 3, the apparatus 200 for manufacturing molten iron according to the second embodiment of the ~~present~~ invention includes a water supply nozzle 65 positioned in the vicinity of the oxygen burners 60 mounted to the outer wall above the dispersing plate 27 in each of the fluidized-bed reactors. The fluidized-bed reactors may include additional equipment as needed.

The paragraph beginning on page 10, line 31 has been changed as follows:

FIG. 4 is a partial sectional view of one of the oxygen burners and its corresponding water supply nozzle according to the second embodiment of the ~~present~~ invention. Since the oxygen burner 60 is identical to that of the first embodiment of the ~~present~~ invention, a detailed description thereof is omitted. The water supply nozzle 65 is structured including a pipe member 651 with an aperture 652 formed therein. Water is supplied through the aperture 652 separately from the oxygen and mixed into the oxygen flame.

In FIG. 4, although the water supply nozzle 65 is shown positioned directly over the oxygen burner 60, such a configuration is shown merely to illustrate the ~~present~~ invention and is not meant to limit the same. Accordingly, it is only necessary that the water supply nozzle 65 be positioned in the vicinity of the oxygen burner 60.

The paragraph beginning on page 11, line 33 has been changed as follows:

In the second embodiment of the ~~present~~ invention, the water supply nozzle 65 is mounted such that a direction along which it supplies water is set at an angle (θ) of $4 \sim 15^\circ$ with respect to a lengthwise direction of the oxygen burner 60. As shown in FIG. 4, in the case where the water supply nozzle 65 is provided above the oxygen burner 60, it is

preferable that the water supply nozzle 65 is slanted downwardly $4 \sim 15^\circ$. If the angle (θ) is less than 4° , the point at which contact is made to the oxygen flame is further extended into the fluidized bed or does not contact the oxygen flame at all. If the angle (θ) exceeds 15° , not only is the supply path of the oxygen flame obstructed, but the amount of time to reach the oxygen flame is too short such that a reduction in temperature of the oxygen flame and the water shift reaction cannot be expected.

The ~~present~~ invention will be described in greater detail below through an experimental example. This experimental example merely illustrates the ~~present~~ invention and is not meant to limit the ~~present~~ invention.

The paragraphs beginning on page 12, line 15 have been changed as follows:

At the same time oxygen is supplied through the oxygen burner, water is supplied through the water supply nozzle to adjust the water supply amount according to the second embodiment of the ~~present~~ invention. A simulating experiment was performed to measure the resulting oxygen flame temperature. The water supply amount is measured using a flow meter, and the oxygen flame temperature is measured using a UV thermometer.

The test results are shown in FIG. 5. FIG. 5 is a graph showing changes in an oxygen flame temperature as a function of water supply amount according to the experimental example of the ~~present~~ invention. In the experimental example of the ~~present~~ invention, an atmospheric temperature is set at 600°C or greater such that an oxygen flame is generated, but since this is a test with respect to an oxygen flame in atmosphere, there may be a difference in the absolute temperature value. However, the reduction in temperature may be predicted as shown in the graph of FIG. 5. The paragraph beginning on page 13, line 8 has been changed as follows:

Since in the ~~present~~ invention oxygen is directly supplied to an area where reduced gas flows to fluidized beds, not only is the negative impact given to the dispersing plate minimized, but the rate of reduction of the iron containing mixture is increased by increasing the temperature of the reduction gas. Therefore, the quality of reduced gas passing through the fluidized beds may be improved and cohesion of the iron containing powder may be prevented.

The paragraphs beginning on page 13, line 18 have been changed as follows:

With respect to the water supply nozzle of the ~~present~~ invention, since there is used process water or steam that enables the process in the manufacture of molten iron to be easily realized, these processes may be more efficiently performed.

Further, in the ~~present~~ invention, in addition to performing the direct supply of and combustion of oxygen in the fluidized beds, a separate oxygen supply apparatus is provided outside the fluidized beds such that the load with respect to oxygen supply may be lessened.

Although embodiments of the ~~present~~ invention have been described in detail hereinabove in connection with certain exemplary embodiments, it should be understood that the invention is not limited to the disclosed exemplary embodiments, but, on the contrary is intended to cover various modifications and/or equivalent arrangements included within the spirit and scope of the present invention, as defined in the appended claims.